



Short communication

Implementation costs of a community health worker delivered weight loss intervention in black churches serving underserved communities

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ARTICLE INFO

Keywords:

Costs and costs analysis
 Body weight
 Community health workers
 Black
 Community-based participatory research
 Churches

ABSTRACT

Black adults bear a disproportionate burden of the obesity epidemic but are underrepresented in weight loss research and lose less weight than their white counterparts in weight loss interventions. Comprehensive behavioral weight loss interventions cause weight loss, but their high cost have stymied their implementation in black and other underserved communities. Recent translations of evidence-based weight loss interventions for black communities have been designed to increase intervention reach. However, the costs of implementing such interventions have seldom been reported in the context of a randomized controlled trial. Thus, the costs of implementing a community-health worker delivered Diabetes Prevention Program (DPP) adapted for rural black adults of faith (The WORD) are reported.

Data from a randomized controlled effectiveness trial conducted in 31 churches (n = 440) were used to calculate implementation costs. All participants received the 16-session core weight loss intervention and weight loss data was collected at baseline and 6 months.

Participants lost an average of 2.53 kg at 6 months. Total implementation costs were \$340.95 per participant. Thus, the implementation cost was \$138 per kg.

This is one of the few comprehensive examinations of costs for a DPP translation for black adults of faith and provide initial data from which practitioners and policy makers can use to determine the engagement of churches to disseminate the DPP through churches. Future studies are needed to confirm the extent churches are a cost-effective strategy to cause weight loss in black communities.

1. Introduction

The Diabetes Prevention Program (DPP) is a comprehensive lifestyle management program that reduces risk of type 2 diabetes and a gold standard behavioral weight loss program adopted by national organizations (e.g. Centers for Disease Control) for nation-wide dissemination, including limited coverage for the program under Medicare (Services USCFMM). Although the DPP has demonstrated clinically significant weight loss and cost effectiveness (Diabetes Prevention Program Research, 2012), the high cost of implementation (\$1399 per participant (Hernan et al., 2003)) has limited its dissemination in underserved communities with limited resources (Wing et al., 2010).

Translations of the DPP to real-world studies have been conducted to facilitate the program's reach; however, few have examined the costs of these translated interventions, particularly interventions adapted for implementation in black communities. Blacks bear a disproportionate

burden of obesity compared to other racial/ethnic groups (with black women having the highest rates of obesity) (Flegal et al., 2012), are underrepresented in behavioral weight loss intervention research (Fitzgibbon et al., 2012), and lose less weight than whites in behavioral weight loss interventions (Fitzgibbon et al., 2012). A handful of DPP translations for black populations have been conducted (Samuel-Hodge et al., 2014), but to the authors' knowledge, few have examined the costs of implementation, with only one to our knowledge (Rhodes et al., 2018) examining costs in the context of a randomized trial. Churches are a central component in many Black communities and their accessibility to underserved groups brings potential for wide-spread implementation and dissemination of evidence-based programs (Maynard, 2017). Thus, the costs of a DPP translation for rural black communities of faith (The WORD) was examined.

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2. Methods

In the context of a randomized-controlled effectiveness trial (NCT02169947) known as The WORD, 31 churches were randomized to two weight loss arms to test the effect of a maintenance component on weight loss maintenance. Both arms received the 16 weekly/bi-weekly core sessions of the DPP adapted for rural black adults of faith, and one arm received an additional 12 maintenance sessions. Thus, all participants received the first 6 months of the weight loss intervention. A total of 440 participants, nested in churches, participated in the study. A total of 61 community health workers (CHWs) (approximately two CHWs per church) were recruited and trained to deliver the intervention in small groups of 8–10 participants. Pastors of participating churches recruited CHWs from their congregations. The study was approved by the University of Arkansas for Medical Sciences Institutional Review Board. Additional details of The WORD trial have been published previously (Yeary et al., 2015). From baseline to 6 months, all participants lost 2.47 (3.13, 1.80) percent of their initial body weight on average (Yeary et al., in press); comparable to other DPP adaptations for black adults (Samuel-Hodge et al., 2014). This paper reports the costs of implementing the core 16 sessions (delivered over 6 months) of The WORD only, which all participants received. Thus, although the data are from a randomized trial, data from both weight loss arms were pooled for analyses.

2.1. Cost measurement

Costs were measured from a third-party payer perspective. This perspective is relevant for any third-party payers, including health insurers, public health agencies, or others who either have a financial incentive to generate weight loss in this population, or who value weight loss in underserved communities as a policy goal. Costs were measured in 2013–2014, and since all costs were incurred during the intervention period, we did not adjust costs for inflation. Thus, the costs we report are in 2013–2014 dollars.

Throughout the duration of The WORD intervention, we tracked all expenses using budget reports. Relevant costs included personnel costs, incentives, materials provided to churches, materials provided to CHWs, and materials provided to participants (Table 1). Master Trainers were trained by investigators, and we accounted for both the investigator time spent training the Master Trainers, as well as Master Trainer time spent receiving training to deliver the intervention. We also included Project Staff Time, or time spent by Master Trainers to train CHWs. Master Trainers' provision of Technical Support was also accounted for. We used hourly rates of \$67.31 for investigators and \$20.70 for Master Trainers, based on study records. CHWs were volunteers, and thus we did not include hourly costs of the CHWs. Since we took the third-party payer perspective rather than a societal perspective, we did not cost volunteer time (Luce and Elixhauser, 1990). CHWs did receive incentives for each session delivered, which were accounted for in our cost tabulation. We excluded the one-time costs of planning and developing the intervention materials, since if this intervention were repeated or scaled up, those costs would not be incurred again.

2.2. Cost-effectiveness

We measured cost-effectiveness in terms of cost per kilogram lost at six months for participants that received the 6-month weight loss intervention. Consistent with typical behavioral weight loss trials testing effectiveness (Lv et al., 2017), weight loss at six months was our primary effectiveness outcome. Weight loss was measured as pre to post change in weight from baseline to six months. For the purposes of this study, we pooled both intervention groups because both groups received the 6-month weight loss intervention, and only diverged after that time. Thus, we calculated the average cost-effectiveness ratio

(ACER) by dividing the average per participant cost by the average weight loss over the measurement period. The ACER is based on the average cost and effectiveness in the population, but it differs from other measures used in health economics, such as the incremental cost-effectiveness ratio (ICER), which measures the marginal difference in cost and effectiveness, and can be calculated from a randomized control trial. While the ICER is often more appropriate for making choices comparing a range of possible policies or interventions, ACERs are useful for making decisions about whether or not to implement a specific intervention (Bang and Zhao, 2014).

3. Results

3.1. Intervention implementation cost

Table 1 reports total costs of The WORD intervention. A total of 31 Black churches, 61 CHWs, and 440 Black adults participated in the intervention; relevant costs were calculated by staffing costs, church-level costs, CHW costs, and participant costs. Staffing costs included training time of Master Trainers to ensure their competency to train CHWs and Master Trainer time to train and support CHWs. Staffing costs per participant were \$30.02 and \$426.13 per church (assuming eight participants per church). The majority of church-level costs came from hospital quality scale costs (approximately \$500 per church). CHW stipends at \$100 per intervention session delivered consisted of the majority of CHW costs. Participant scales at approximately \$20 per participant were the costliest item provided to participants. Total cost per participant was \$348.95 per participant or \$2791.56 per church.

3.2. Implementation cost per kilogram lost

Participants lost an average of 2.53 kg or 5.58 lbs per person. Thus, The WORD intervention was associated with weight loss at \$138 per kg, or \$63 per pound.

4. Discussion

This is one of the first studies to examine the costs of a DPP translation delivered by CHWs for a black underserved community. In another study that translated the DPP for black adults of faith, implementation costs were approximately \$96 per pound lost (intervention caused 2.1 kg weight loss compared to control), the costs of which are higher than The WORD intervention (Rhodes et al., 2018). Boltri et al. (2011) in their DPP adaptation for black churches reported lower costs per pound (1.7 kg lost from baseline to post-intervention follow-up; \$13 per lb lost) but did not include staff time and training costs, which typically account for 40%–54% of total costs in DPP translations (Hernan et al., 2003; Ingels et al., 2016). Both Ingels et al. (2016) and Samuel-Hodge et al. (2013) engaged diverse worksite or health department-based samples where about half were black, and reported similar cost per pound lost (Ingels reported weight loss of 2.7–2.9 lbs in treatment groups compared to a 2.7 wt loss in the control; \$41–\$56 per pound lost; Samuel-Hodge reported 3.3 kg lost in treatment compared to control from baseline to 5 months; \$40 per pounds lost). However, cost analyses were not conducted separately by race/ethnicity and given that blacks typically lose less weight than whites in behavioral weight loss interventions, the cost per pound lost may have been considerably higher among blacks. Perri et al. (2008) reported an exploratory analysis of costs in their community-based weight loss intervention in an underserved diverse sample, but analyzed the costs of the maintenance components of their intervention only.

To the authors' knowledge, this is one of the first studies to conduct a comprehensive cost analysis of a DPP adaptation for black adults of faith. Given the paucity of cost reporting of DPP translations for blacks, it is unclear how the cost of implementing a DPP translation in black churches would compare to available alternatives. The WORD caused

Table 1

Intervention implementation costs for a community-health worker delivered translation of the Diabetes Prevention Program for rural African American churches (The WORD)—2013–2018 (costs in 2013–2014 dollars).

	Quantity	Unit costs	Total cost	Per participant (n = 440) cost
<i>Staffing costs</i>				
Master Training	Mean 40 h per Master Trainer	\$67.31 per hour of investigator time for each Master Trainer \$20.7 per hour of Master Trainer (staff) time	\$3520.4	\$8.00
Project staff time (Master Trainer) for training	Mean 12.5 h per church (31 churches)	\$20.7 per hour of staff time	\$8021.25	\$18.23
Technical support	Mean 2.6 h per church (31 churches)	\$20.7 per hour of staff time	\$1668.42	\$3.79
<i>Church-level costs (n = 31 churches)</i>				
Church Scale	1 per church	\$499.99	\$15,499.69	\$35.23
Church exercise DVD	1 per church	\$8.49	\$263.19	\$0.59
Fat Demonstration Tubes	1 per church	\$33.93	\$1051.93	\$2.39
<i>Community-Health Worker (WORD Leader) costs (n = 61 WORD Leaders)</i>				
Word Leader incentives	16 sessions delivered by each WL	\$100 per session for each WL	\$97,600	\$221.81
Training materials (binder, printing set-up fee, materials)	1 set per WL	\$9.32	\$568.52	\$1.29
Calorie Counter for WORD Leaders (WL)	1 per WL	\$7.40	\$451.40	\$1.03
Food Scales	1 per WL	\$7.93	\$483.73	\$1.10
Calculator for WLs	1 per WL	\$1.59	\$96.99	\$0.22
Measuring Cups for WLs	1 per WL	\$2.29	\$139.69	\$0.32
Measuring Spoons for WLs	1 per WL	\$1.35	\$82.35	\$0.19
<i>Participant costs (n = 440 participants)</i>				
Participant binder	1 per participant	\$8.12	\$3572.8	\$8.12
Keeping Track Books	24 per participant	\$0.29	\$3021.12	\$6.96
Participant scale	1 per participant	\$18.75	\$8250	\$18.75
Measuring cups	1 set per participant	\$2.29	\$1007.60	\$2.29
Measuring spoons	1 set per participant	\$1.35	\$594	\$1.35
Portion plate	1 per participant	\$1.77	\$778.80	\$1.77
Calorie Counter for participant	1 per participant	\$7.93	\$3489.20	\$7.93
Calculator	1 per participant	\$1.59	\$699.60	\$1.59
Pedometer	1 per participant	\$6.00	\$2640	\$6.00

weight loss that was higher than the mean weight loss reported by a meta-analysis of DPP translations in real world settings (Dunkley et al., 2014), and in the range of other DPP adaptations for black adults (Samuel-Hodge et al., 2014), some of which utilized health professionals. Given the higher cost of health professionals compared to CHWs, The WORD may be less costly to implement compared to previous DPP adaptations for blacks. Removing or replacing costly items that the intervention incorporated (e.g. Tanita scale to each church at \$500 per scale) and are not necessary for intervention scale-up would have further lowered the program's implementation cost. However, future studies examining the costs of DPP adaptations for black adults would be needed to confirm this.

Black churches are the bedrock of many black communities and easily accessible to community members (Lancaster et al., 2014). Consequently, engaging churches has been a commonly used approach to reach black communities (Lancaster et al., 2014). The study's results provide initial information regarding cost for practitioners and policy makers considering faith-based translations of the DPP for black communities, though future studies are needed to determine how the cost of implementing the DPP through churches compare to other settings.

Limitations of the study include the lack of a true control group in analyses of weight loss from baseline to 6-months, as participants in both arms received the same core weight loss intervention; however, given the substantial evidence-base of the DPP, it is reasonable to assume that significant weight loss occurred in the treatment group. Data regarding the costs of weight loss maintenance was also not reported.

5. Conclusions

Multiple strategies reaching black underserved communities are needed to address the health inequities in overweight and obesity that

have persisted in the U.S. Black churches may be a cost-effective implementation strategy, but further research reporting costs in the context of translational weight loss trials for blacks are needed (Lancaster et al., 2014). Future interventions thoroughly assessing the cost-effectiveness of engaging different community-based sites including churches are needed to fully understand and harness the potential of faith-based and other institutions to cause weight loss in marginalized communities.

6. Clinical trial registration

NCT02169947.

Funding

This work was supported by National Institutes of Health Grant 2P20MD002329-06.

CRediT authorship contribution statement

Karen H. Kim Yeary: Conceptualization, Formal analysis, Writing - original draft, Writing - review & editing, Visualization, Funding acquisition. **Cameron M. Kaplan:** Conceptualization, Formal analysis, Methodology, Writing - original draft, Writing - review & editing. **Ellen Hutchins:** Investigation, Writing - review & editing, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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